

**US ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT
CIVIL DESIGN SECTION**

**UPPER YORK CREEK
ECOSYSTEM RESTORATION PROJECT
FEASIBILITY REPORT
ENGINEERING APPENDIX**

August 2006

Upper York Creek Ecosystem Restoration Feasibility Study

Civil Design

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1.0 INTRODUCTION

1.1 Location and Study Area Description

The Upper York Creek Ecosystem Restoration Project is within the five-square-mile York Creek drainage basin and is located northwest of the city of St. Helena, Napa County, 60 miles north of San Francisco (See Figure 1). York Creek is a tributary to the Napa River, flowing in an easterly direction from the California Coast Range on the western side of the Napa Valley watershed and through a narrow canyon before joining the Napa River north of downtown St. Helena. Elevations range from about 220 feet at the Napa River confluence to 2,160 feet in the headwater areas over a reach length of about 2.5 miles.

The upper and larger part of the watershed is located in unincorporated areas of the county while the lower and smaller portion of the basin lie within the city limits of St. Helena. The watershed is sparsely populated mountainous terrain with urbanization accruing downstream of the existing dam area. Redwoods and mixed conifer forest dominate the riparian corridors in the upper watershed, while mixed hardwood forest and vineyards cover much of the remaining watershed with urban and developed areas in the lower reaches. The watershed is almost entirely privately owned, and vehicle access exists via Highway 29 (Main Street) and Spring Mountain Road in St. Helena.

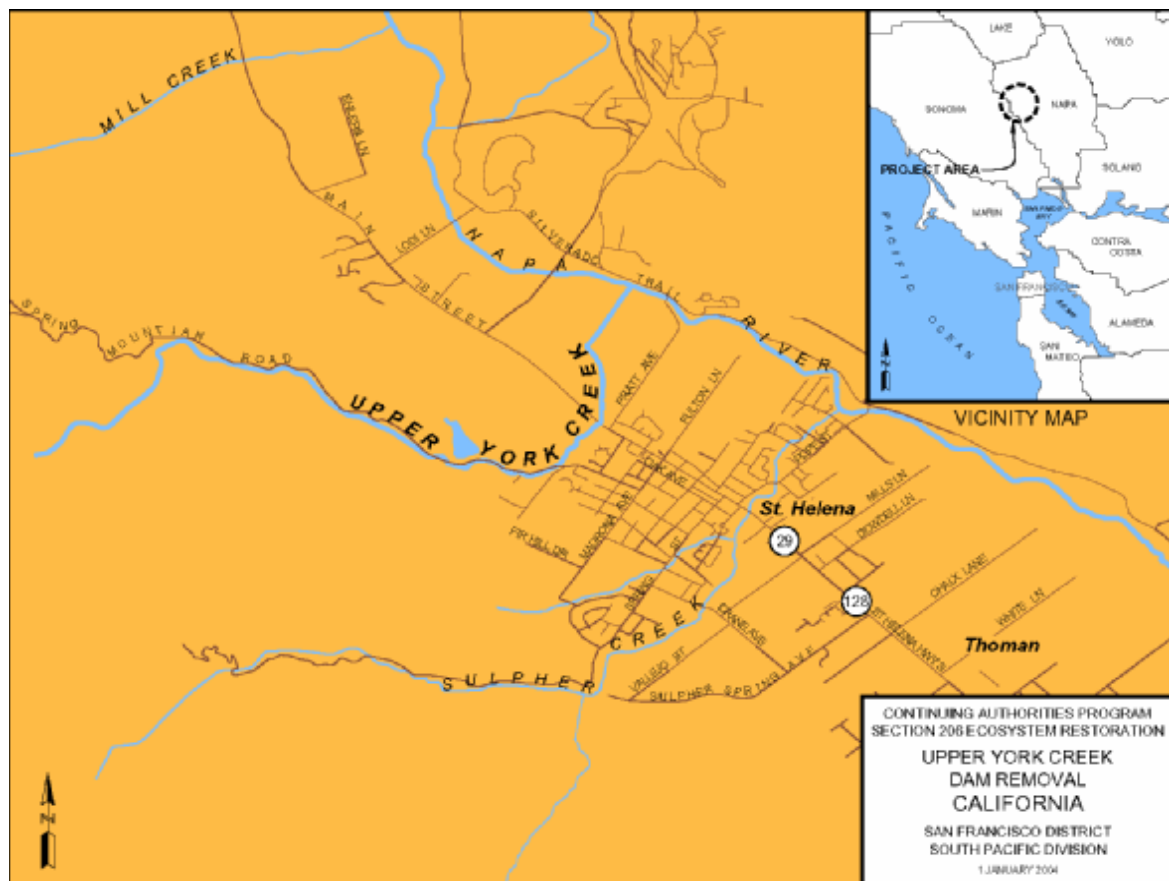


Figure 1

1.2 Project Site

The 2.1-acre project site is located at York Creek Dam (St. Helena Upper Dam) and Upper Reservoir, in York Creek Canyon, approximately 1.25 miles northwest of the city of St. Helena. At an elevation of 570 feet, the earthen dam was built by the city circa 1900 and is composed of approximately 12,670 cubic feet of material that came from soil excavated to create the three-acre Upper Reservoir. The 50-foot-high, 140-foot-long structure once impounded water to form the reservoir, which had a 10-million-gallon storage capacity and was used for municipal water supply. Use of the reservoir has since been abandoned because of sedimentation.

Both sides of the dam are faced with basaltic fieldstone riprap. A six-foot-diameter steel intake pipe is located immediately behind the upstream side of the dam and extends vertically down 26 feet to a stone culvert. This culvert is 175 feet long and 3 feet in diameter, and leads to an outlet at the base of the dam's downstream side. The dam features two concrete spillways, one built simultaneously with the dam and the other constructed in 1933. The original spillway is located on the south side of the dam, whereas the second spillway runs along the north side and Spring Mountain Road.

2.0 ALTERNATIVE PLAN DESIGN SUMMARY

2.1 Plan Preparations

The plans and profiles for the four alternative plans are provided in Appendix 1. The topographic surveying was originally performed in March 2002 by Albion Surveys, Inc through a contract with the City of St. Helena. Coordinates of the topographic surveying map are based local or project horizontal system which is not been yet tie into the California Coordinates System of 1983, Zone II, and the vertical controls are based on NGVD 29 Datum with Digital Tertian Model (DTM) files provided by the City.

The DTM is used for three dimensional perspective view generation, slope and volume computation and drainage system generation. One of steps that consumes substantial time and effort is manual contour line digitizing. InRoads by Bentley computer software is utilized in this project to create the new surface and channel alignment.

Digitized information, such as hydrographic features, trees, infrastructure, and many other data components were organized into different CAD layers so that further computation was possible. The new and existing cross sections are also generated in order to compute the estimate the volume of earthwork required for this project. Table 6 shows the estimated project earthwork volume, which was generated by the InRoads software. This software was also used to create the proposed topographic surfaces and channel alignment. Ancillary project features have been transposed to the drawings by means of digitizing.

2.2 Description of Alternative Plans

Design alternatives were based on hydraulic and geotechnical analysis. Channel gradients of Alternatives 1, 2A and 2B are designed to maintain a low-erosion flow velocity (approximately 5.09% slope). Alternative 3 has a different slope configuration to accommodate a 145 feet long fish ladder (STA 0+000 to STA 0+300 - 5.09%, STA 0+300 to STA 0+430 - 23.23% and STA 0+430 to STA 1+100 - 3.06%) while retaining sufficient energy to minimize sediment deposition and reduce the frequency of maintenance (See Figure 2). Nevertheless, channel gradients of these alternatives may be modified in a future study due to a paucity of bedrock survey data necessary to make a quality DTM file.

The proposed trapezoidal channel has a bottom width of 23 feet and 5 feet in depth and either 1.5H : 1V or 2H : 1V side slopes. The excavation angle into the hillsides above the channels ideally would have been 2H: 1V for long term stability, but since the natural hillside slope angles are as steep as 1H: 1V in places, steeper cuts may be necessary (See Figure 3). The benches along the channels will vary to satisfy flood control requirements. The riprap would be placed at the notch of the dam with additional 1 feet of freeboard for both Alt. 2A and Alt. 2B (See Figure 12 and H&H appendix for details). Inclined screw anchors would be required between STA 350 and STA 383 for geotechnical slope stability except Alt 3 (See Geotech. appendix for details).

The four primary objectives of this project are:

1. To improve fish passage through Upper York Creek by restoring access to approximately two miles of spawning and rearing habitat for federally listed steelhead and other aquatic wildlife.
2. To restore more natural sediment transport processes along the creek and reduce the risk of uncontrolled sediment releases at Upper York Creek Dam.
3. To restore approximately two miles of degraded riparian and riverine habitat at and above Upper York Creek, removing sediment accumulated behind the dam.
4. To provide aquatic and riparian migration and dispersal connectivity for fish and wildlife populations through the project site.

The following alternatives have been chosen to be most feasible for achieving the project objectives.

Alternative 1: Complete Removal of Dam and Spillway (See Figure 4)

Alternative 1 involves the complete removal of the dam, spillway, standpipe, and accumulated sediment with the construction of a floodplain bench through the dam site and the restoration of two acres of degraded habitat above the dam to a more natural riverine and riparian state. To contain higher flows, it is recommended that up to 30 feet wide bench with a trapezoidal channel, depending on the available room be constructed to the side of the channel wherever possible through the project site.

Alternative 2A: Maximum Notch Size on the Dam (See Figure 5)

Alternative 2A involves the notching and/or removal of a portion of the dam to provide for fish and aquatic wildlife passage, filling the concrete spillway with on site sediment, removing of standpipe and accumulated sediment, and restoring two acres of degraded habitat above the dam to a more natural riverine and riparian state. This alternative has trapezoidal channel with 9 feet bench.

Alternative 2B: Minimum Notch Size on the Dam (See Figure 6)

Alternative 2B involves the notching and/or removal of a portion of the dam to the minimum hydrological allowable width (based on slope stability concerns) while providing for fish and aquatic wildlife passage. Also included are the filling of the concrete spillway with on-site sediment, removal of the standpipe and accumulated sediment, and the restoration of two acres of degraded habitat above the dam to a more natural riverine and riparian state.

Compared with 2A, Alternative 2B is more geotechnically favored alternative as it leaves the majority of the dam in place allowing for a higher level of slope stability. The primary difference between alternatives 2A and 2B is that alternative 2B provides for the minimum hydrologic passageway to handle 100-year flood levels in order to maximize the slope stability as deemed ideal by the geotechnical report. This alternative has only trapezoidal channel without 9 feet bench.

Alternative 3: Fish Ladder and Notch of Dam to Streambed (See Figure 7)

Alternative 3 involves notching of the dam as necessary to construct a fish ladder through the notch and over the dam, filling the concrete spillway with site sediment, removal of accumulated sediment, and restoration of two acres of degraded habitat above the dam to a more natural riverine and riparian state.

The notch would be cut from the top of the dam with sediment behind the dam being stabilized to create a more natural creek to feed into the top of the fish ladder.

3.0 PLAN IMPLEMENTATION

3.1 Dewatering Process

In order to implement any one of the construction work of Upper York Creek Ecosystem Restoration Project alternatives it requires to dewater the creek to provide a dry land to perform the construction work, such as sediment removal, channel contouring, dam removal, and fish ladder installation.

There are several ways to accomplish dewatering. First one needs to know the stream water flow rate, site topographic condition, and designed operational objective. Given the magnitude of work to be performed in the Upper York Creek project a complete isolation

of the water from the creek bed within the needed work area appears to be the only choice.

The first devise to water from entering into a work area is the construction of a cofferdam. Since cofferdam is an impermeable structure to be constructed by combination of material such as rock, sandbags, wood, sheet metal, or gravel, it can be installed to block the flow from upstream and with combination of a bypass channel either formed by a earthen flow pass or by piping to facilitate a section of dry land. Water is then being pumped to across the dam, in this case, and flow into the bypass channel and provided the isolation. There are other types of portable cofferdam to be constructed by different method or material, such as Fas-Dam which is available commercially. There are varieties of different systems and constructions of cofferdam for contractors to choose.

If cofferdams are installed to dewater long section of stretch, then a temporary channel must be provided to bypass the dry work area and convey water from upstream to downstream. A temporary channel can be either an excavated ditch or a pipe laid alongside the dewatered stretch. Depending on channel grade and flow rate, pipes can be used with or without the use of a pump to draw upstream water and transport it downstream. Sufficient space and suitable topography are necessary to excavate ditches, while sufficient flow capacity of temporary channels is imperative to mitigate the possibility of storm flows inundating a work area (See Figure 8).

3.2 Construction Methodologies

Heavy earthmoving equipment will be used to remove the dam, accumulated sediments, and other existing structure such as the original concrete spillway located on the western side of the dam face. The original spillway has been abandoned and replaced with one on the east side of the dam-adjacent to Spring Mountain Road. If the concrete spillway adjacent to Spring Mountain Road will be partially or completely removed saw cut will be used to separate the spillway walls from the remaining concrete body to enable partial removal of the reinforced concrete structure. The remaining portions of the spillway body and any created void space will then be filled and buried by using on-site materials from the dam structure thus to reduce the volume of dam material. Earthmoving equipment are also used to construct the bank slope, placing rock to provide slope stabilization, and placing cobbles to form part of the fish habitat structures. A sturdy access road is to be constructed along the ramp to provide the heavy equipment's in and out traffic route from the bed to the public road.

Two existing access roads to the Upper York Creek Dam bed from public road are still barely visible (See Figure 9). Both roads require improvements before it can accommodate heavy equipment traffic for this project. One of the access roads is a simple gravel path while the other, from the top of the dam, is in better shape. The major work around the dam bed area will be carried out by either earth moving equipments or the hauling trucks. Furthermore, the trucks will need sufficient space for turning around

at both ends; the loading and disposal sites in order to accommodate the turning radius of semi-end trucks, 30' in length (minimum)

Estimated Material Quantity in cubic yards (yd³)

Alternative 1						
	CUT	UNIT	FILL	UNIT	NET	UNIT
Reach 1	- 1025	yd ³	299	yd ³	- 726	yd ³
Reach 2	- 16284	yd ³	1	yd ³	- 16283	yd ³
Reach 3	- 28100	yd ³	52	yd ³	- 28048	yd ³
Total	- 45409	yd ³	352	yd ³	- 45057	yd ³

Alternative 2A						
	CUT	UNIT	FILL	UNIT	NET	UNIT
Reach 1	- 827	yd ³	290	yd ³	- 537	yd ³
Reach 2	- 12029	yd ³	1	yd ³	-12028	yd ³
Reach 3	- 26637	yd ³	51	yd ³	- 26586	yd ³
Total	- 39493	yd ³	342	yd ³	- 39151	yd ³

Alternative 2B						
	CUT	UNIT	FILL	UNIT	NET	UNIT
Reach 1	- 830	yd ³	288	yd ³	- 542	yd ³
Reach 2	- 11777	yd ³	1	yd ³	- 11776	yd ³
Reach 3	- 26637	yd ³	51	yd ³	- 26586	yd ³
Total	- 39244	yd ³	340	yd ³	- 38904	yd ³

Alternative 3						
	CUT	UNIT	FILL	UNIT	NET	UNIT
Reach 1	- 969	yd ³	298	yd ³	- 671	yd ³
Reach 2	- 8431	yd ³	3	yd ³	- 8428	yd ³
Reach 3	- 10372	yd ³	104	yd ³	- 10268	yd ³
Total	- 19772	yd ³	405	yd ³	- 19367	yd ³

*** Reach 1 – STA 0+000 to 0+275 (Downstream of dam material)

*** Reach 2 – STA 0+275 to 0+415 (Dam material)

*** Reach 3 – STA 0+415 to 1+100 (Reservoir/Sediment material)

A portion of the dam material will be used to fill the void space around the spillway. Sediment accumulated immediately upstream of the dam will be used to form a more natural creek channel. Before the material is hauled away it will first be sorted or screened to separate the cobble fraction and then be stockpiled nearby. Approximately

400 CY of dam material is needed to be used to re-construct the channel slope. The net amount of material to be removed from the site will be different from alternative to alternative. Ranging from 20,000 CY to 45,000 CY of sediment will be hauled or dredged from the site. It will either be disposed of away from site (same as dam material) or placed 75% of material in the St. Helena lower reservoir (located approximately 1 mile downstream from the project site) and 25% of material in a permitted landfill, Clover Flat (located approximately 8.5 miles from the project site). It will approximately take 30-50 truck loads per day along the route between the project site and the lower reservoir. Each load will need 30 minutes to turn around between the two locations for lower reservoir site and 60 minutes for Clover Flat. Each load will carry 12.5 CY of material by a commercial end-dump truck. By calculation if 3 10-wheeler end-dumps for lower reservoir and 6 10-wheeler end-dumps for Clover Flat can run total 48 cycles for one 8 working hour day by 16 cycles per truck rate. This will move total 600 CY a day. Traffic control will be required along this two lane (both way) and busy with traffic most of the time country road called Spring Mountain Road. A minimum of 2 flaggers one each at the both ends of the routing section. Measures shall also be taken into consideration to reduce the amount of mud being tracked along the road and hence creating air borne asbestos fibers. This could be done either by paving the access road with imported AB base gravel as asbestos free surfacing material or by setting up the de-con station to de-contaminate the trucks' tires each time.

3.3 Channel Creation and Sediment Removal with Mechanical Excavation

The excavation methods used to best create the proposed stream are the choice of the contractor. Nevertheless, some anticipated operations will be discussed. One common method of channel formation/excavation is called wet trenching. An alternate method is diversional trenching. In general, wet trenching can be used for streams with low flows, diversional trenching can be used on larger streams. Prior to initiating excavation at the project site, an erosion control barrier should be erected between excavation areas and downstream-of-project areas. The erosion control barrier may consist of sandbags and a double layer of staggered straw bales. In general, wet trenching can be used for streams with low flows, whereas diversional trenching can be used on larger streams. The first step is to construct the temporary dam and flume upstream. This is mostly a manual operation assisted by a loader or backhoe from the shore. The main flow path of the stream is routed around the portion of the intended stream excavation using a flume or pipe bypass. Adjacent to the grading area, the stream will be sandbagged both upstream and downstream, forming dams across this area of the stream, thus directing the stream flow through the bypass pipe. This method is effective in preventing an increase in stream water turbidity from excess sediment channel.

3.4 Hydraulic Dredge for Sediment Removal

Hydraulic dredges can provide a fast means may be also more economical to remove and transport sediments in the upper reservoir to the lower reservoir in the form of called slurry pumping. Nevertheless, some limitations of hydraulic dredges for this application always present which include: a) a minimum of 500 gallons per minute flow through the

system has to be maintained b) the maximum practical size of material can be mass transported in this slurry pumping system is approximately 2 inches or smaller; c) hydraulic dredges cannot handle objects like rock, concrete, tree branches or other kind of debris other than soil sedimentation pond will be needed at the receiving end disposal site; and e) potential pipeline blown-ups are always probable. If this hazard is unacceptable to environmental concern then this hydraulic dredging method is really questionable for this project.

3.5 Fish Ladder Construction

Alternative 3 will be involved with the construction of a fish ladder, using cast-in-place reinforced concrete to form the footing, base and steps. First, the concrete footing with reinforcement will be constructed, then the concrete forms for wall can be set up for the concrete wall and reinforcement to be constructed (See Figure 10).

3.6 Brushmattress Description

The riprap slope at the dam removal site will be covered by a willow brushmattress. The brushmattress will extend from below the toe of the slope to the top of the riprap. Lightweight steel cable toggle type soil anchors (similar to duckbill brand anchors) will be placed in the slope to be available to tie down the brushmattress. Prior to placement of the brushmattress soil will be placed in the voids of the riprap and in an approximately 6" layer over the top of the rock. Heavy coir fabric will be placed on top of the soil. A six inch layer of tightly packed willow cuttings will be placed on the slope in a vertical orientation. The willow cuttings will be fastened down using heavy twine and the cable soil anchors. Soil will be carefully placed on the willow cuttings until the cuttings are in good contact with the soil and only the top layer of cuttings is mostly exposed. The brushmattress may require irrigation in the first year of two after construction until it is well rooted and established. The brushmattress construction may be changed to suit site conditions as of yet unknown and other construction factors not yet determined (See Figure 11).

3.7 Grade Control

Current design alternatives have not included plans for significant grade control. However grade control may be necessary for the following reason. During construction of the dam the York Creek's natural gravel streambed may have been removed to prevent seepage under the dam. Also there may have been disturbance to the creek upstream of the dam during construction. Current alternative designs have assumed that the original channel bed material wood still be in place and be available for the restored design. This may not be true therefore channel restoration may require grade control for the final restored channel bed. Grade control should be planned for however the required extent and locations will not be known until construction is under way and the proposed projects creek bed is exposed.

4.0 EQUIPMENT FOR CONSTRUCTION

The Construction Contractor shall use the best suited standard earth moving equipment for accomplishing the job as long as is approved by the Government. Some standard equipment needed for this type of project may include backhoes, front loaders, bulldozers, graders and dump trucks. A 6' x 12' screening station is needed to be setup for screening the material before stockpiled at the location for being loaded onto end-dump trucks. Bulldozer and compactor will be used at the lower reservoir to finish grading and compaction operation after received the material from end-dump trucks. Through all operation effort is required to maintain the sediment and soil for transportation remain to be in wet condition all the time.

5.0 LAND SUPPORT

Support equipment for transportation will be required and will depend, to some degree, on the transport method. For example, a staging area will be required for operational support (not related to dredged material) including loading and offloading of personnel, spare parts, fuel, oil and lubricants.

6.0 CONSTRUCTION WINDOW

Construction activities in the project area will occur from June to October during daylight hours, beginning after 8 AM and ending before sunset each day. Night work will not be allowed. Sediment hauling on Spring Mountain Road will be completed by October 15th coinciding with the end of the construction window for streams supporting salmonids.

7.0 TRAFFIC IMPACTS FROM CONSTRUCTION

Project construction would result in a temporary increase in truck traffic, primarily along Spring Mountain Road. Most of the truck traffic, approximately 30 - 50 roundtrips per day, would result from hauling sediment to the lower reservoir, moving boulders to the project site for construction of weirs, and hauling gravel and cobble material for construction of cofferdams and pools between the boulder weirs. Hauling traffic through St. Helena and on Spring Mountain Road has the potential to cause temporary impacts to traffic along the hauling route. Trucks turning in and out of the project site may also cause traffic hazards. Materials disposition traffic will be subject to potential delay and re-routing as wine production traffic increases during harvest and crush beginning in mid-September.

The following mitigation measures will reduce project-related traffic impacts to a level that is less than significant. The contractor shall prepare a traffic control plan and provide a copy for Caltrans review and approval. The plan shall identify the following: staging areas; space for truck turnaround; dump sites; operating hours; project duration; scheduling; phasing; the total number and type of construction vehicles; and respective vehicle haul routes per project phase. Hauling along State Routes 29 and 128 shall be limited to off-peak hours (between 9:00 AM and 3:00 PM) to the extent possible. The

contractor will be required to provide standard Caltrans traffic controls for trucks entering and leaving the roadway. To minimize wear on roads, dump trucks will be filled such that their maximum weight is 10% less than the legal limit of 60,000 pounds on Spring Mountain Road. The City and county will evaluate degradation of road conditions by surveying and documenting road conditions before and after project implementation.

8.0 UTILITIES

There are no major utility lines found within the project foot print per Underground Service Alert's (USA) preliminary search. Erosion protection shall be applied at existing storm water culverts underneath Spring Mountain Road (see Figure 12). It is also recommended that USA is contacted (at 1-800-277-2600) at least two working days before planned digging.

9.0 RECOMMENDATION

1. There are currently two access roads to the Upper York Creek Dam site. Both roads will require improvements to allow the heavy vehicle traffic associated with this project.
2. New site survey data will be collected to evaluate sediment material during rainfall condition in December 2006.
3. A new and more detailed land survey data of bedrock will be required to make a quality DTM file which will determine channel gradients of the final alternative.

10.0 REFERENCES

General Electric Company, Hudson River PCBs Superfund Site, April 12, 2004

U.S. Army Corps of Engineers (USACE) EM 1110-1-5025, Dredging & Dredged Material Disposal, March 25, 1983

U.S. Army Corps of Engineers (USACE) EM 1110-1-4007, Safety and Health Aspects of Hazardous, Toxic, and Radioactive Waste Remediation Technologies, August 15, 2003

FIGURE 2

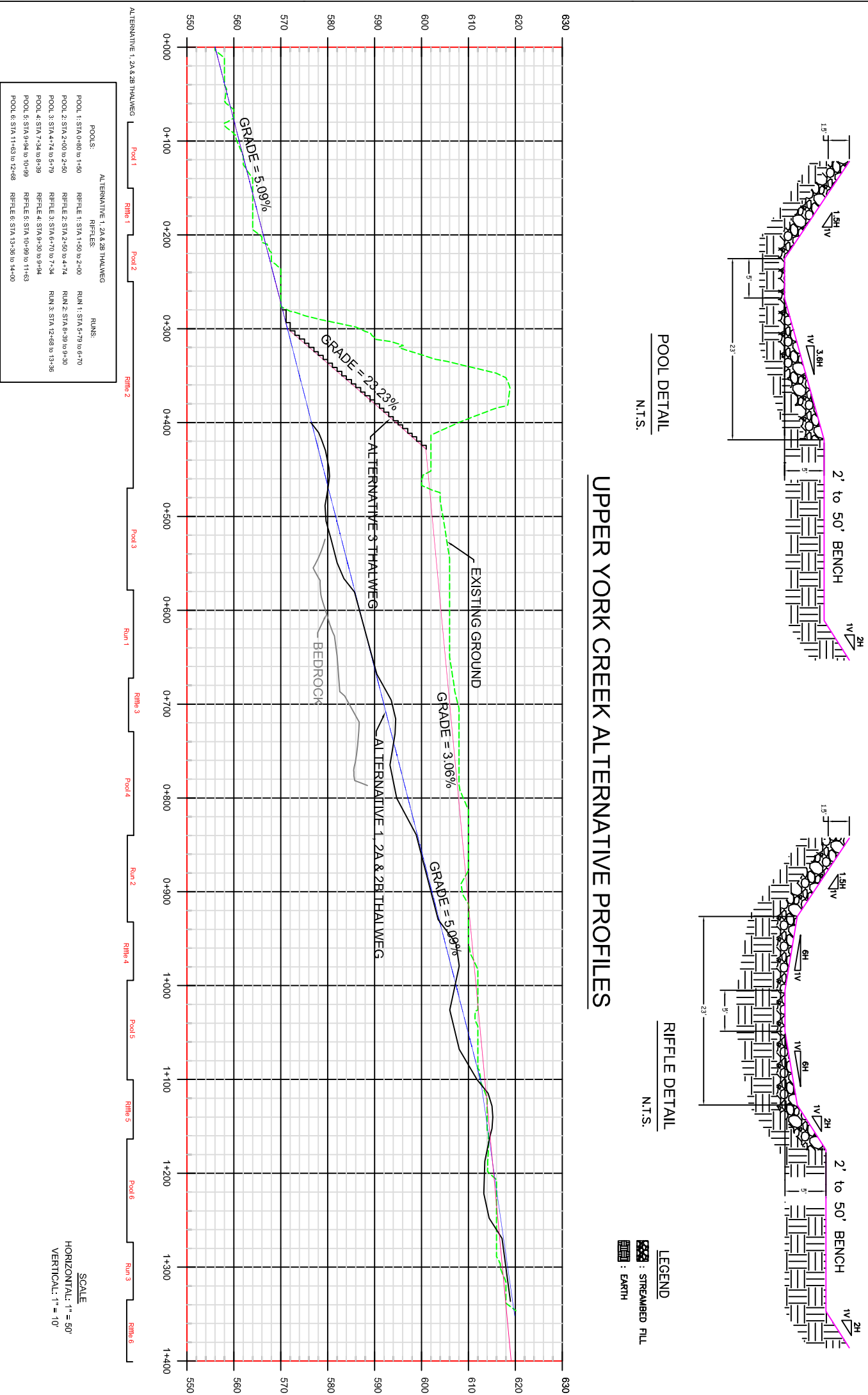
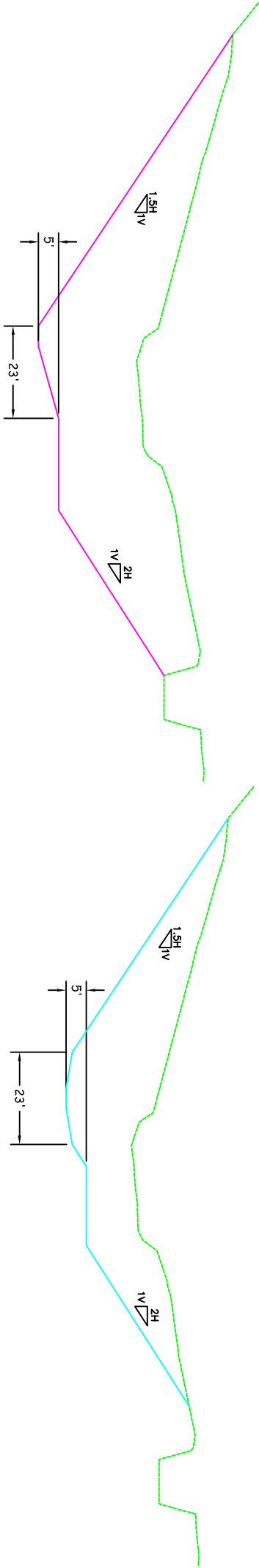


FIGURE 3 - 1

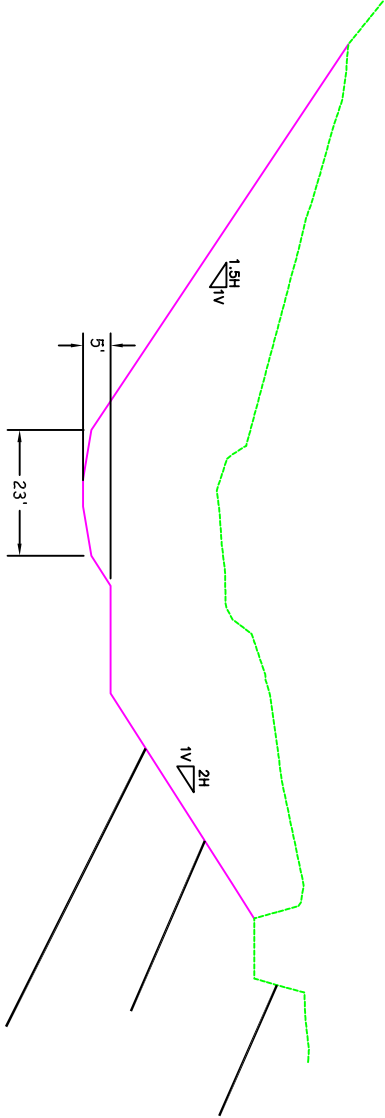
ALTERNATIVE 1



ALTERNATIVE 3

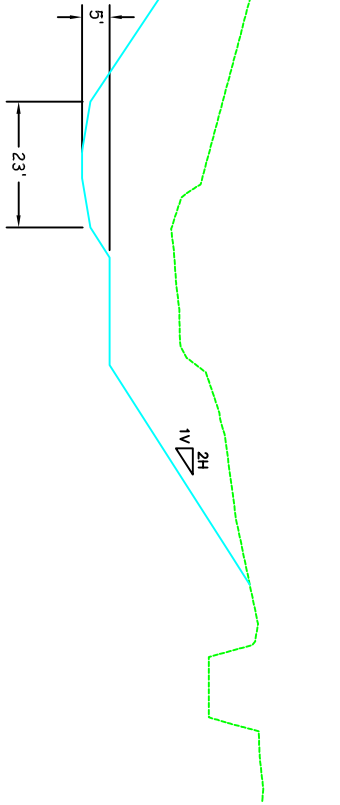
TYPICAL CROSS SECTION: POOL

N.T.S.



TYPICAL CROSS SECTION

N.T.S.



TYPICAL CROSS SECTION: RIFFLE

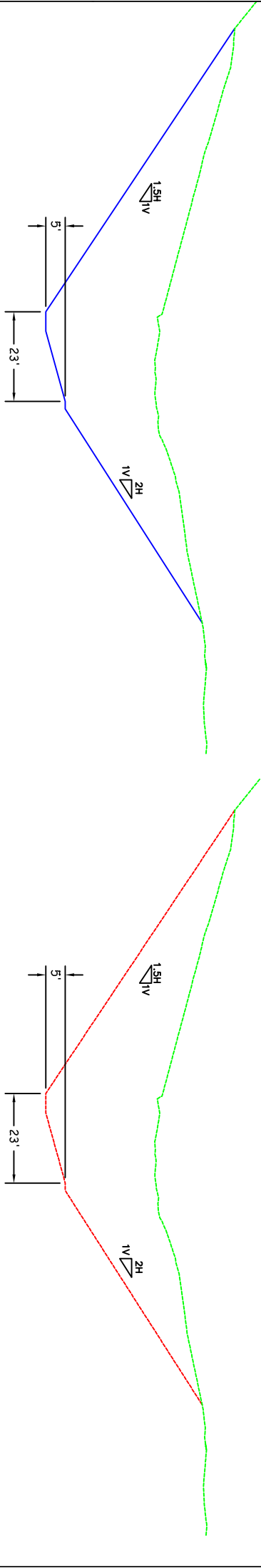
N.T.S.

- LEGEND**
- : INCLINED SCREW ANCHORS
(ONLY STA 350 TO STA 383)
 - : EXISTING GROUND
 - : ALTERNATIVE 1
 - : ALTERNATIVE 3

FIGURE 3 - 2

ALTERNATIVE 2A - REACH 1 AND 3

ALTERNATIVE 2B - REACH 1 AND 3

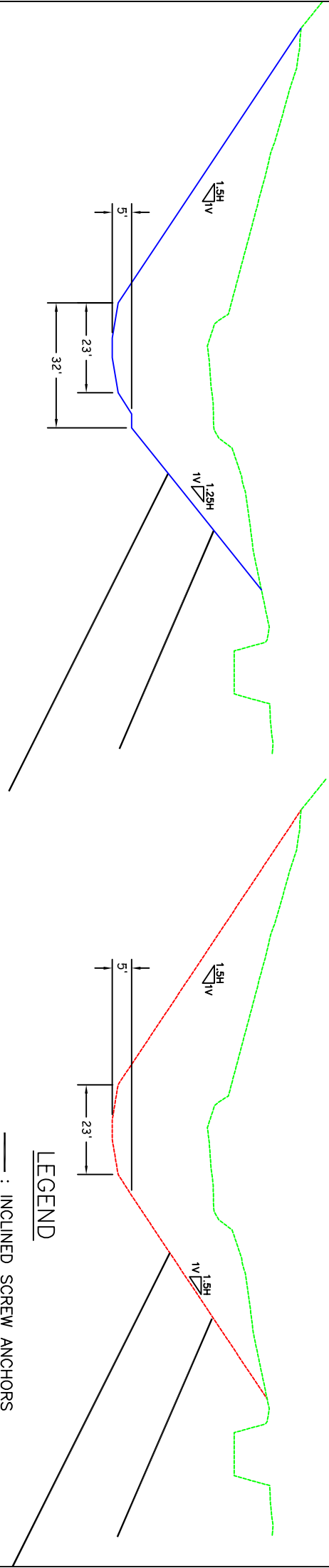


TYPICAL CROSS SECTION: POOL

N.T.S.

ALTERNATIVE 2A - REACH 2

ALTERNATIVE 2B - REACH 2



TYPICAL CROSS SECTION: RIFFLE

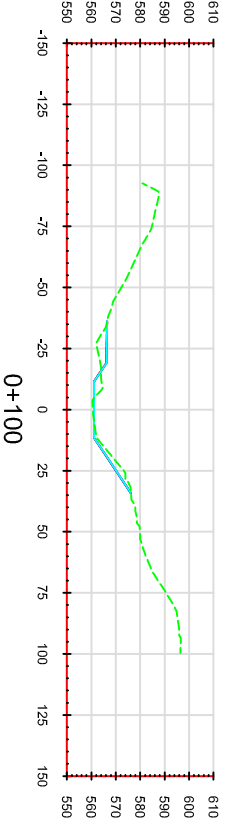
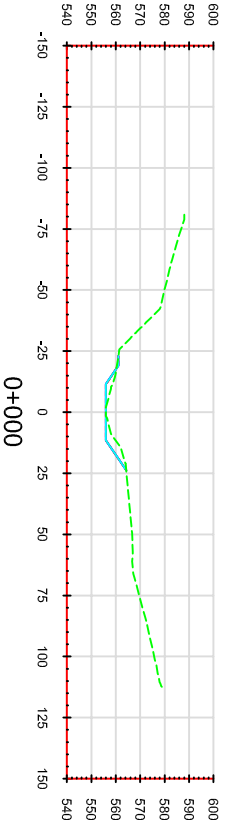
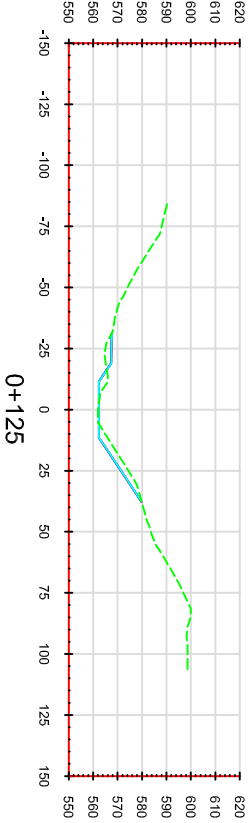
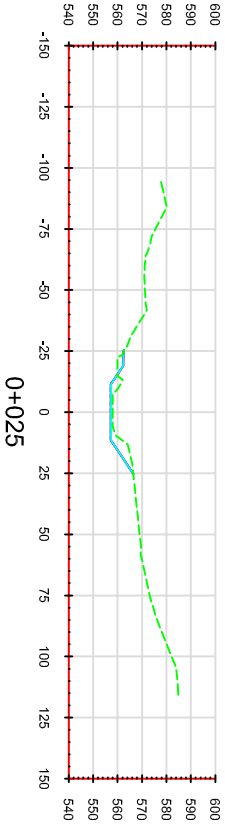
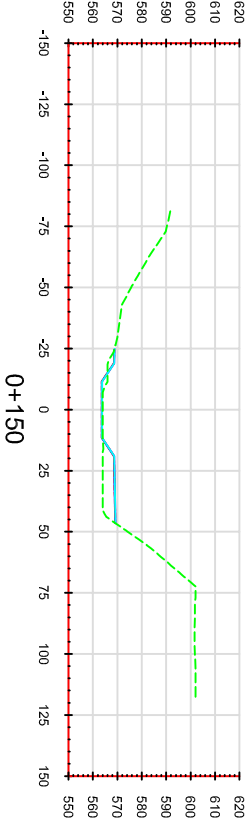
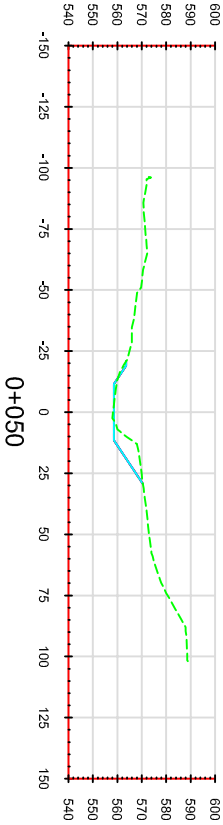
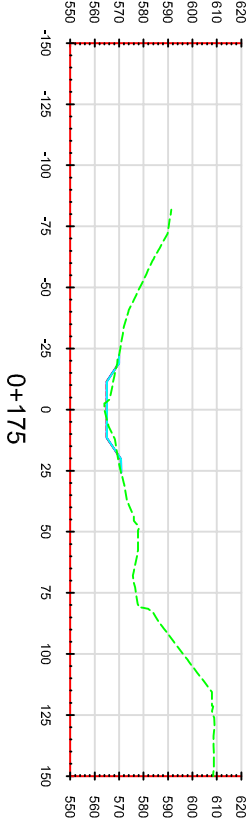
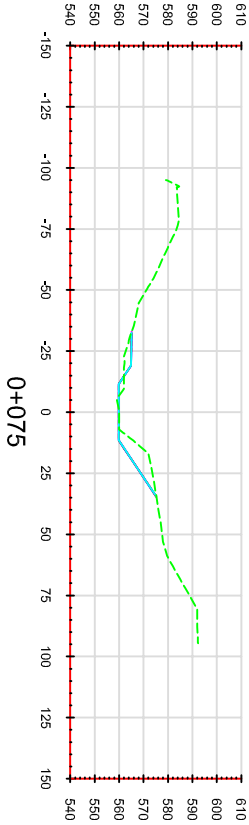
N.T.S.

LEGEND

- : INCLINED SCREW ANCHORS
(ONLY STA 350 TO STA 383)
- - - : EXISTING GROUND
- : ALTERNATIVE 2A
- - - : ALTERNATIVE 2B

FIGURE 3 - 3

STA. 0+000 TO STA. 0+175



SCALE: 1" = 30'

LEGEND

- EXISTING GROUND
- ALTERNATIVE 1
- ALTERNATIVE 2A
- ALTERNATIVE 2B
- ALTERNATIVE 3
- BEDROCK
- TREE

FIGURE 3 - 4

STA. 0+200 TO STA. 0+350

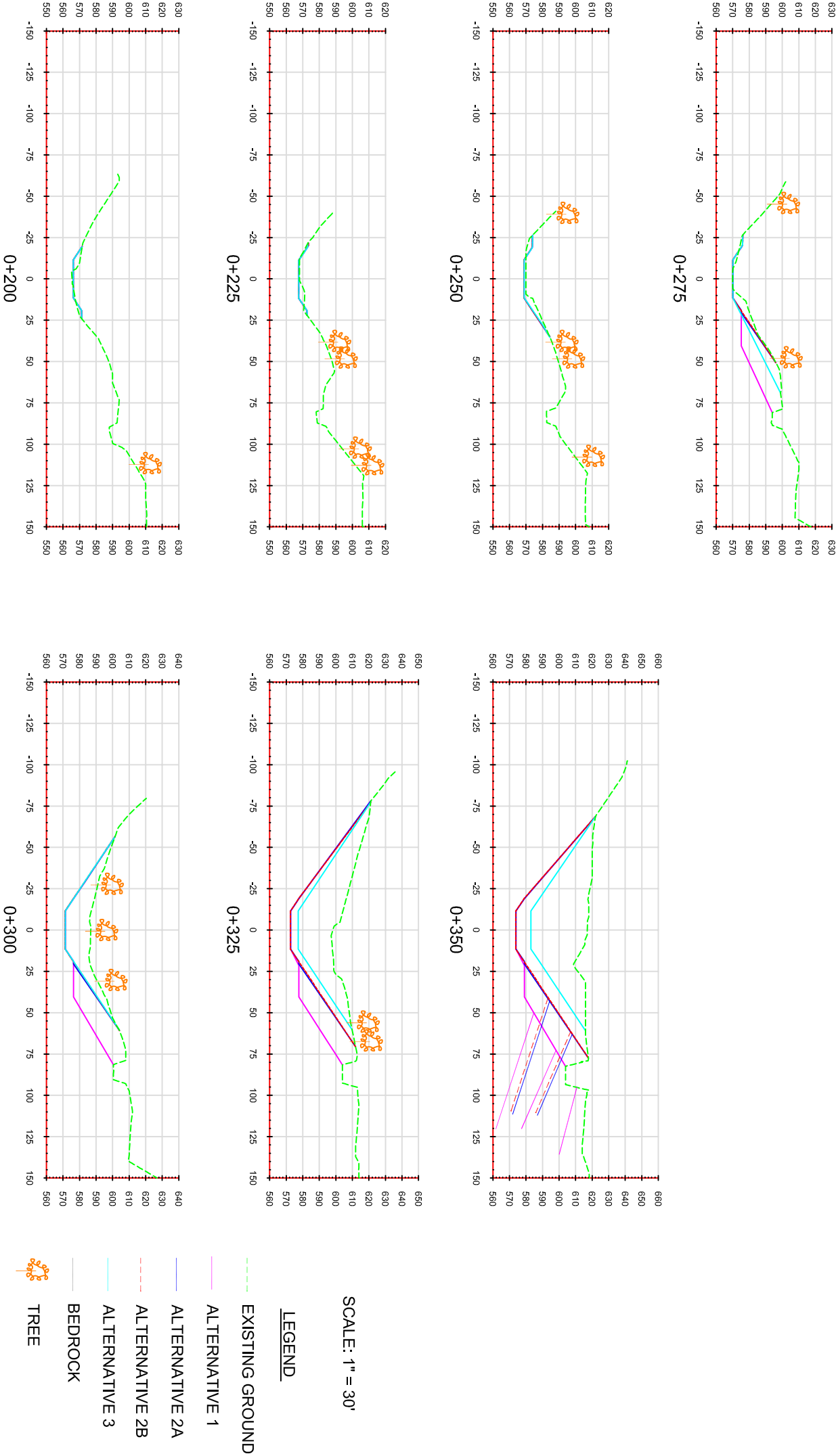
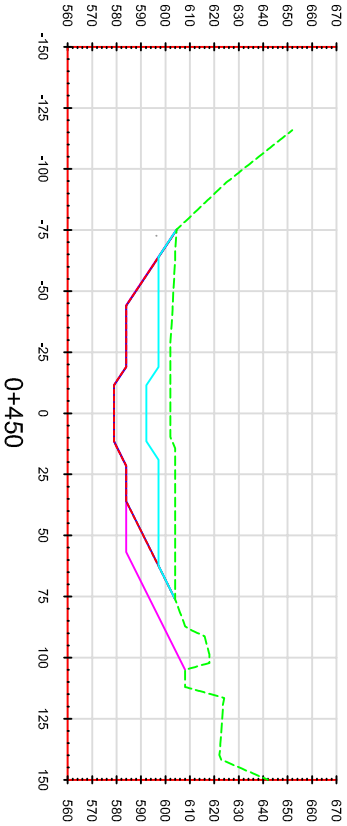
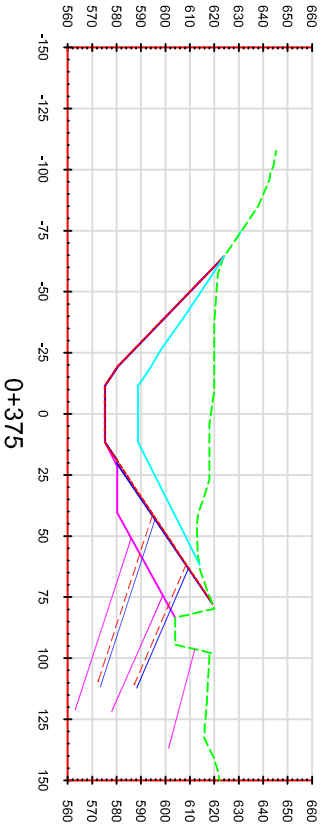
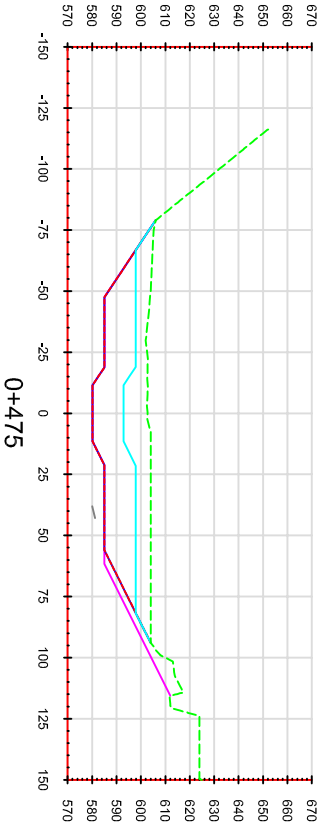
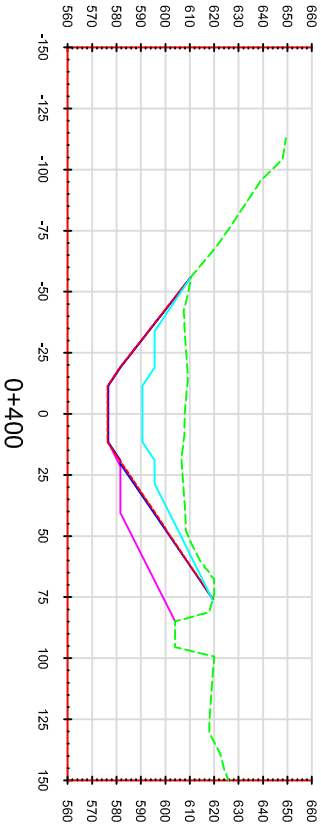
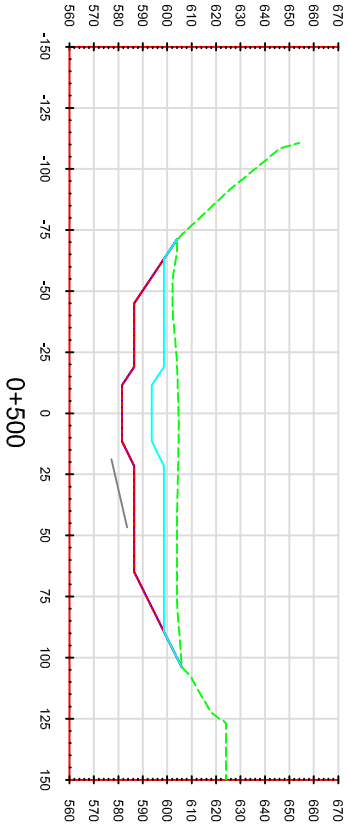
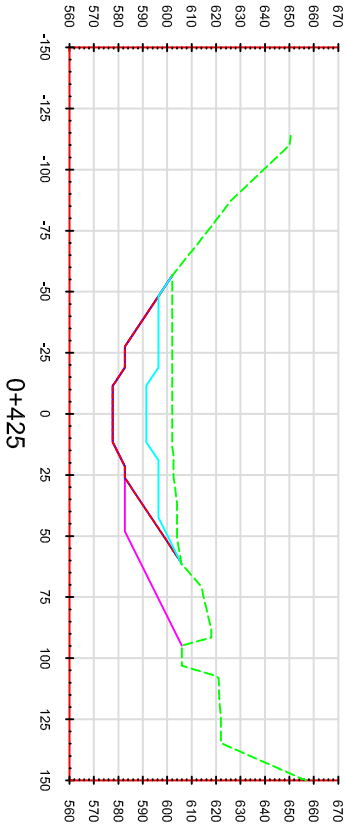


FIGURE 3 - 5

STA. 0+375 TO STA. 0+500



LEGEND

SCALE: 1" = 30'

--- EXISTING GROUND

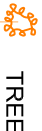
--- ALTERNATIVE 1

--- ALTERNATIVE 2A

--- ALTERNATIVE 2B

--- ALTERNATIVE 3

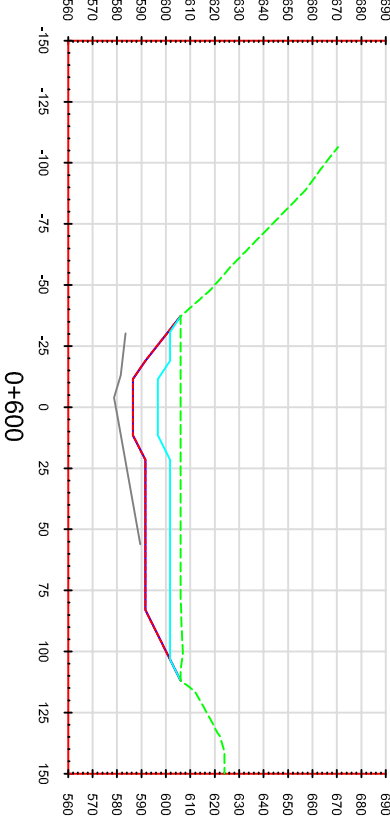
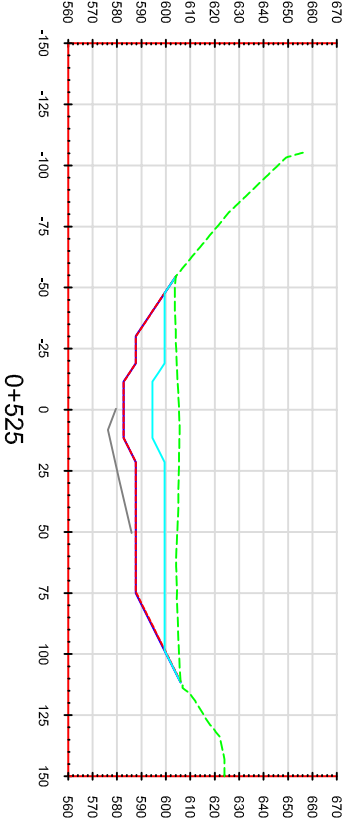
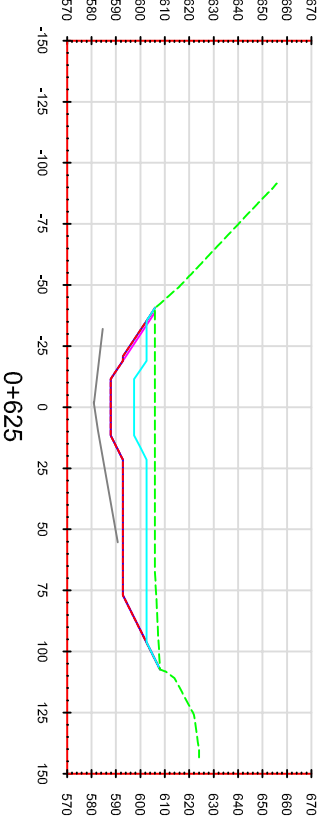
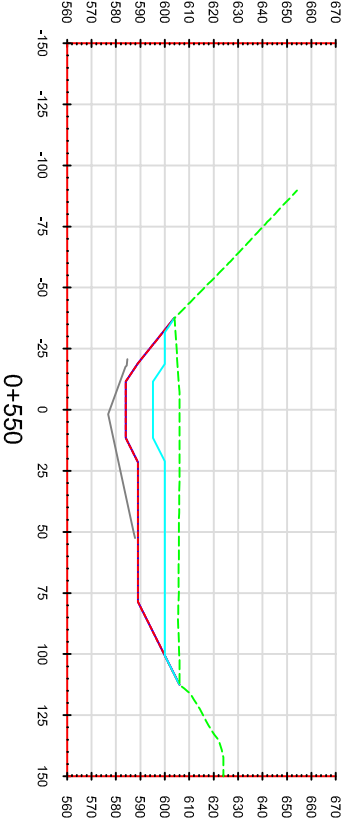
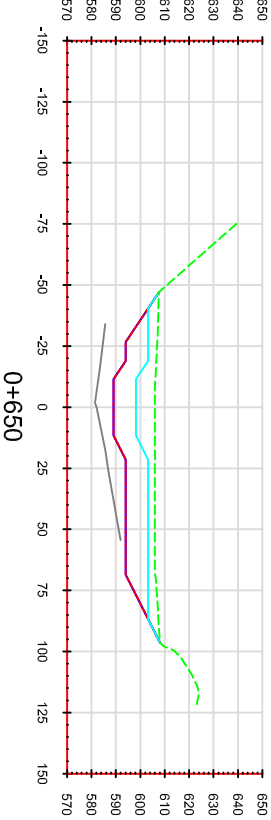
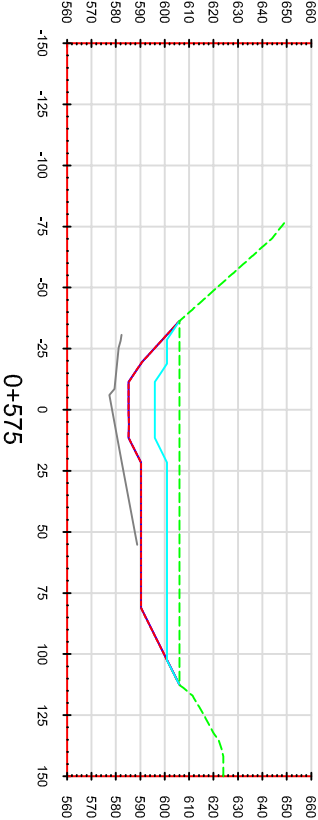
--- BEDROCK



TREE

FIGURE 3 - 6

STA. 0+525 TO STA. 0+650



SCALE: 1" = 30'

LEGEND

- EXISTING GROUND
- ALTERNATIVE 1
- ALTERNATIVE 2A
- ALTERNATIVE 2B
- ALTERNATIVE 3
- BEDROCK
- TREE

FIGURE 3 - 7

STA. 0+675 TO STA. 0+825

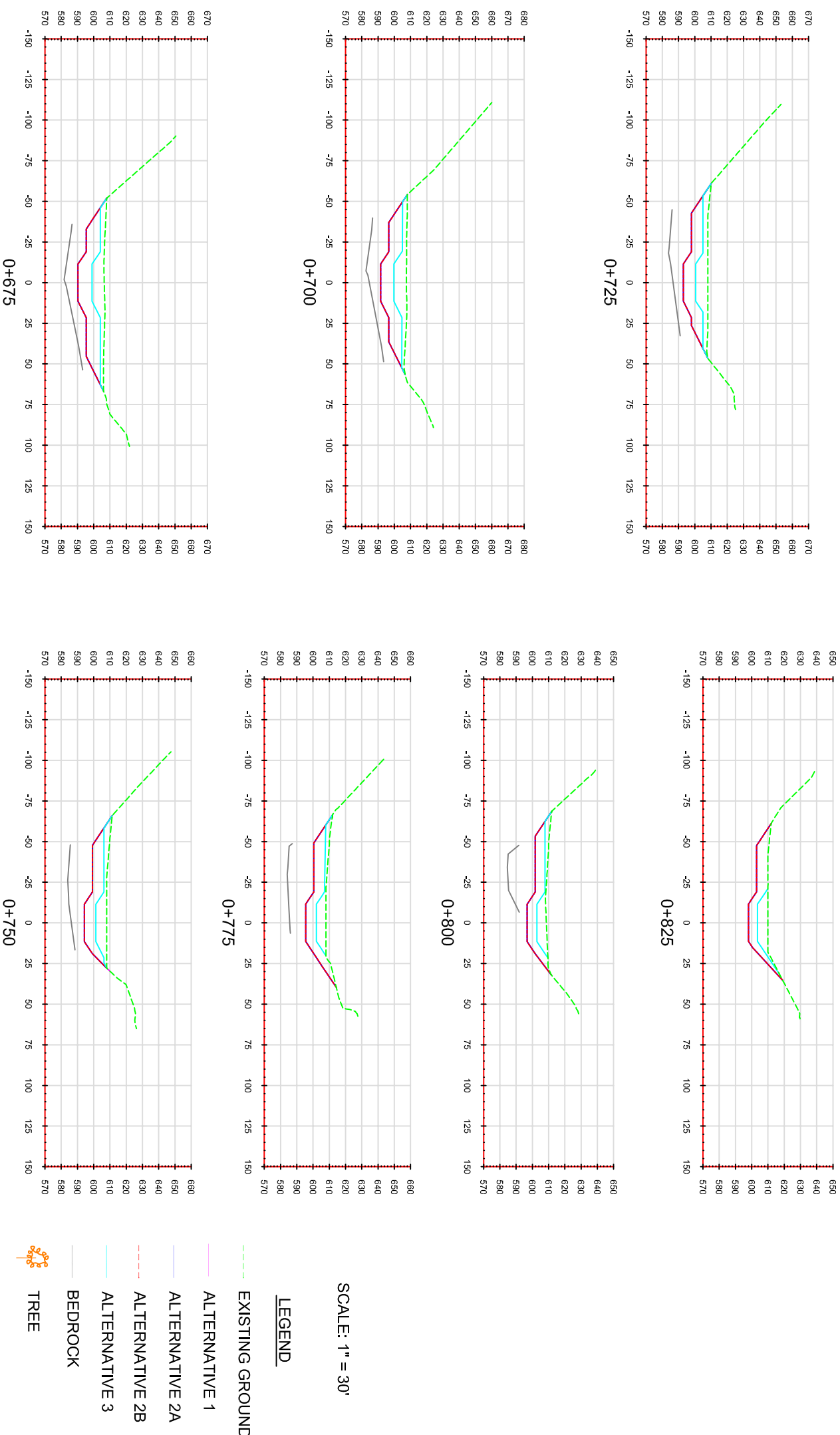
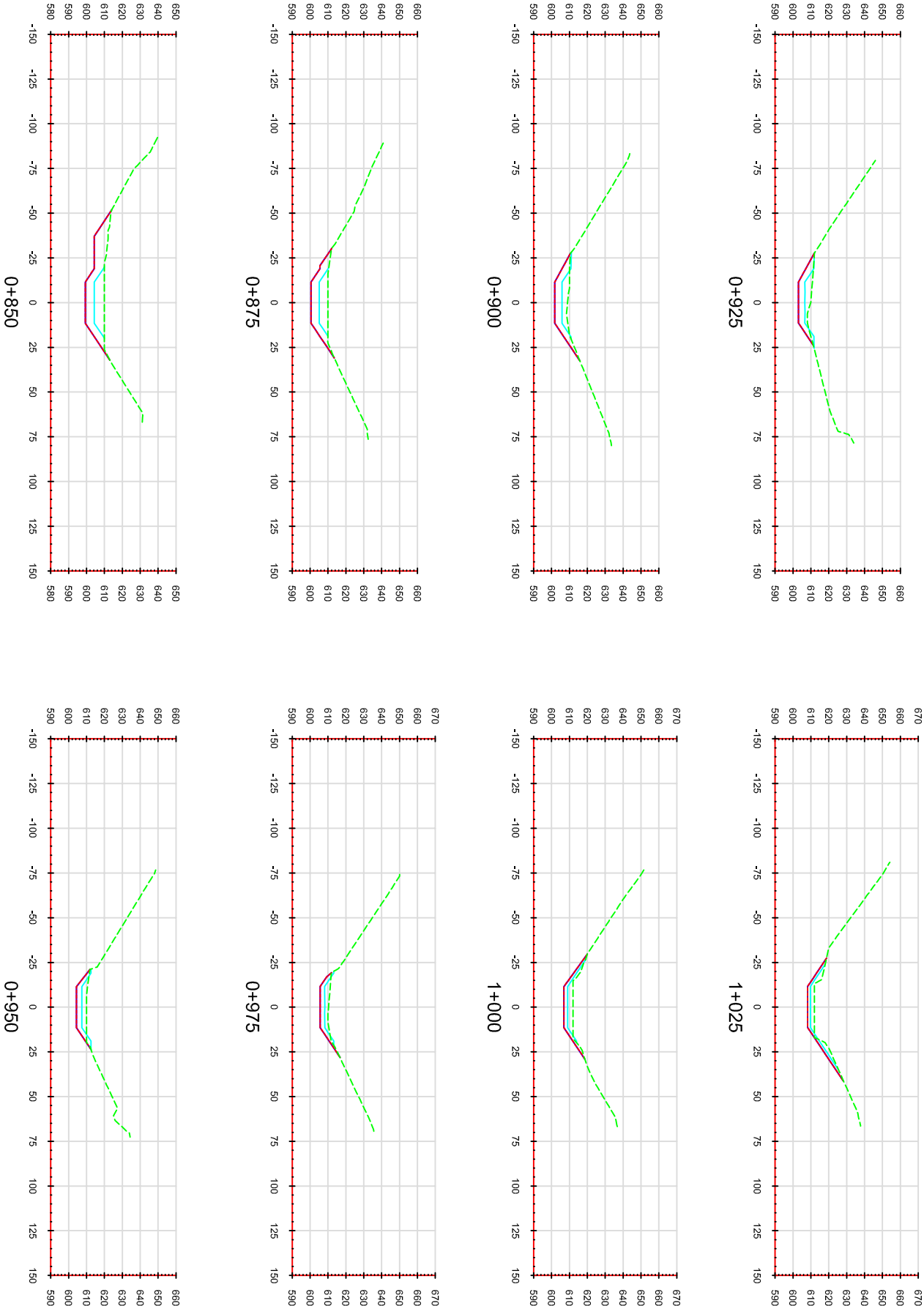


FIGURE 3 - 8

STA. 0+850 TO STA. 1+025



SCALE: 1" = 30'

LEGEND

--- EXISTING GROUND

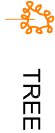
— ALTERNATIVE 1

— ALTERNATIVE 2A

- - - ALTERNATIVE 2B

— ALTERNATIVE 3

— BEDROCK



TREE

FIGURE 3 - 9

STA. 1+050 TO STA. 1+225

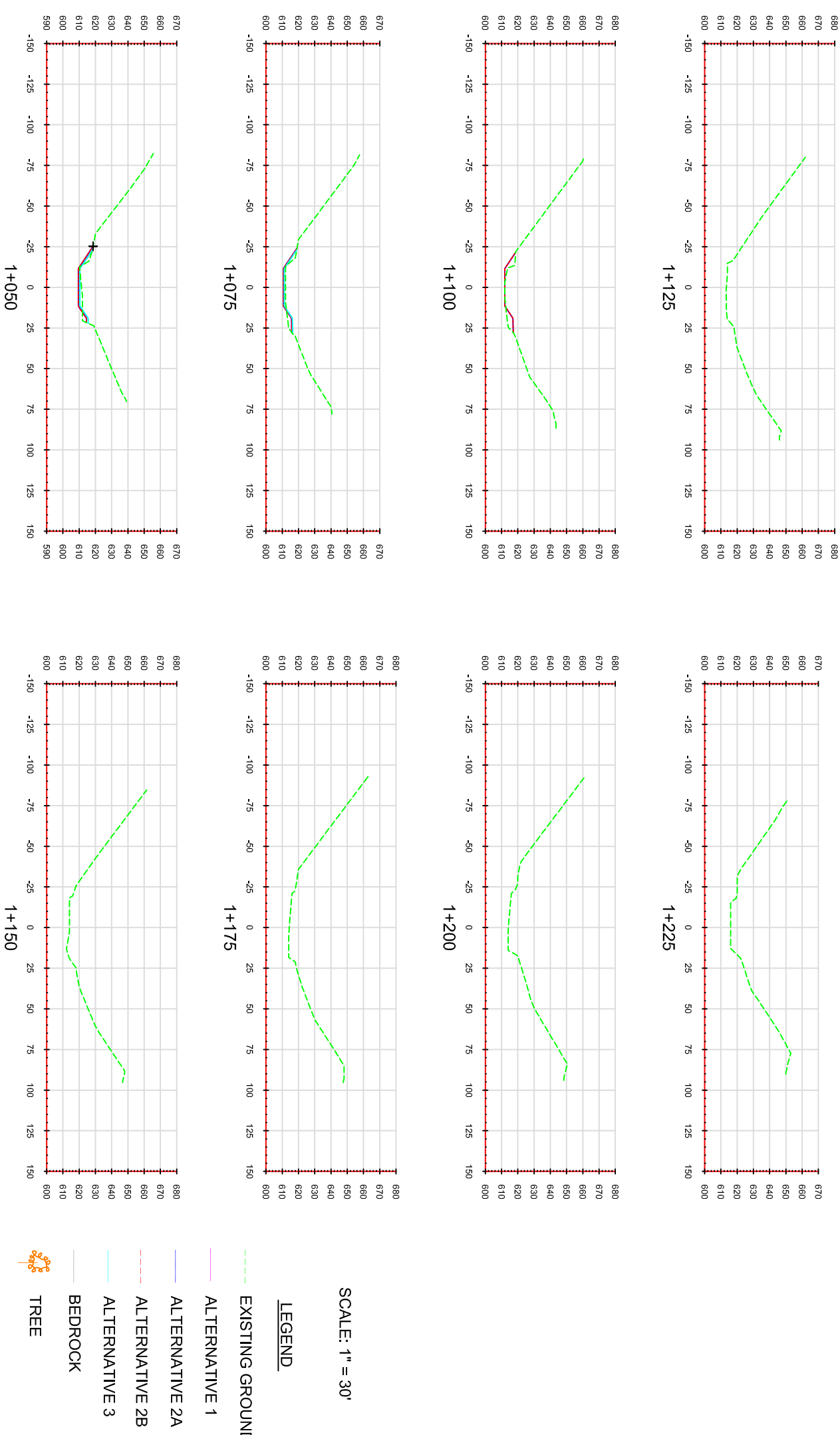
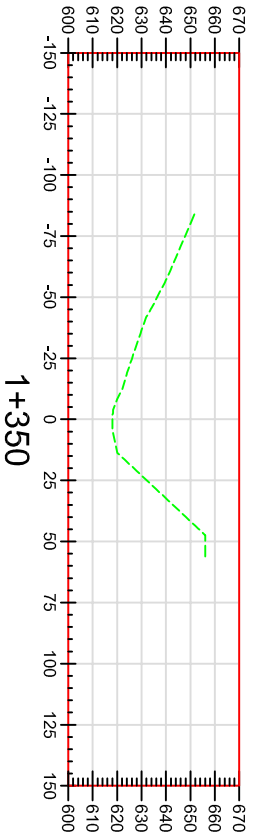
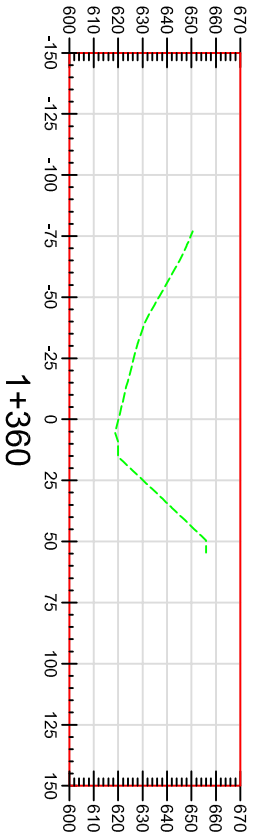
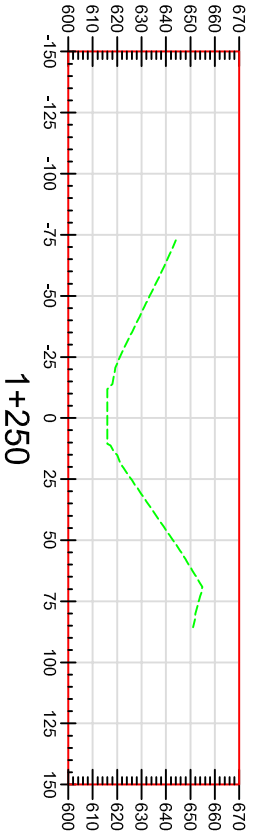
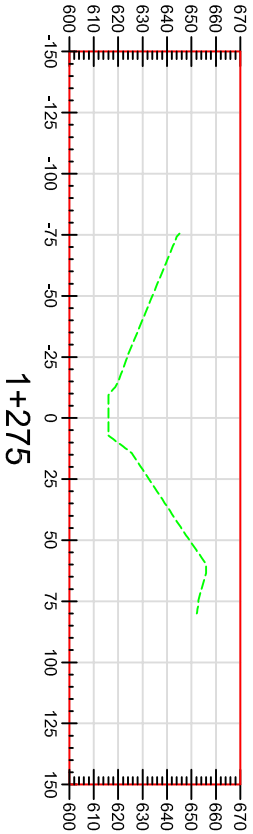
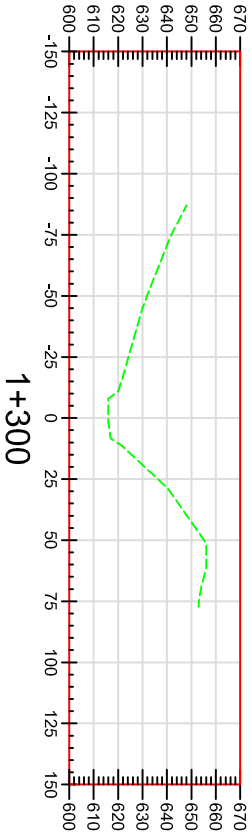
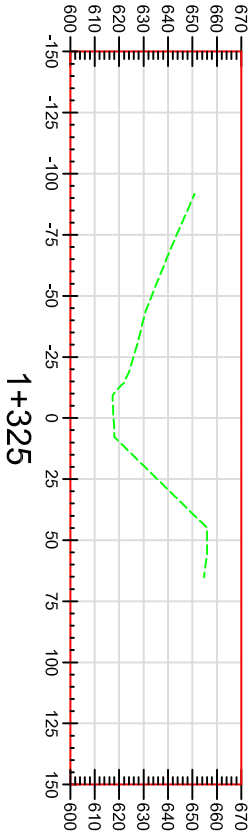


FIGURE 3 - 10

STA. 1+250 TO STA. 1+360



SCALE: 1" = 30'

LEGEND

--- EXISTING GROUND

--- ALTERNATIVE 1

--- ALTERNATIVE 2A

--- ALTERNATIVE 2B

--- ALTERNATIVE 3

--- BEDROCK


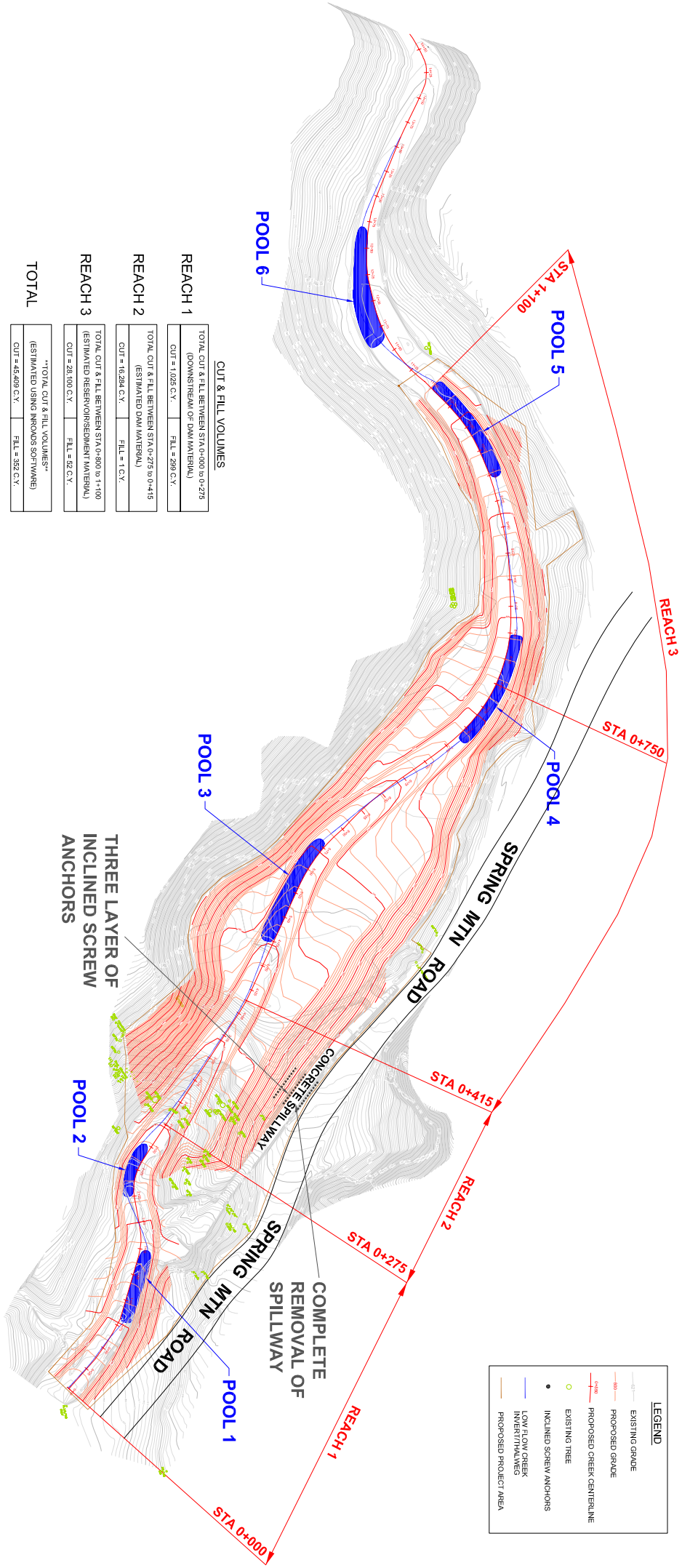
 TREE

FIGURE 4

ALTERNATIVE 1 : STA 0+000 to 1+100 - Grade 5.09%

SCALE: 1" = 50'



NOTE:
1. COMPLETE REMOVAL OF DAM AND SPILLWAY
2. WIDE BENCH WITH TRAPEZOIDAL CHANNEL

FIGURE 5

ALTERNATIVE 2A : STA 0+000 to 1+100 - Grade 5.09%

SCALE: 1" = 50'

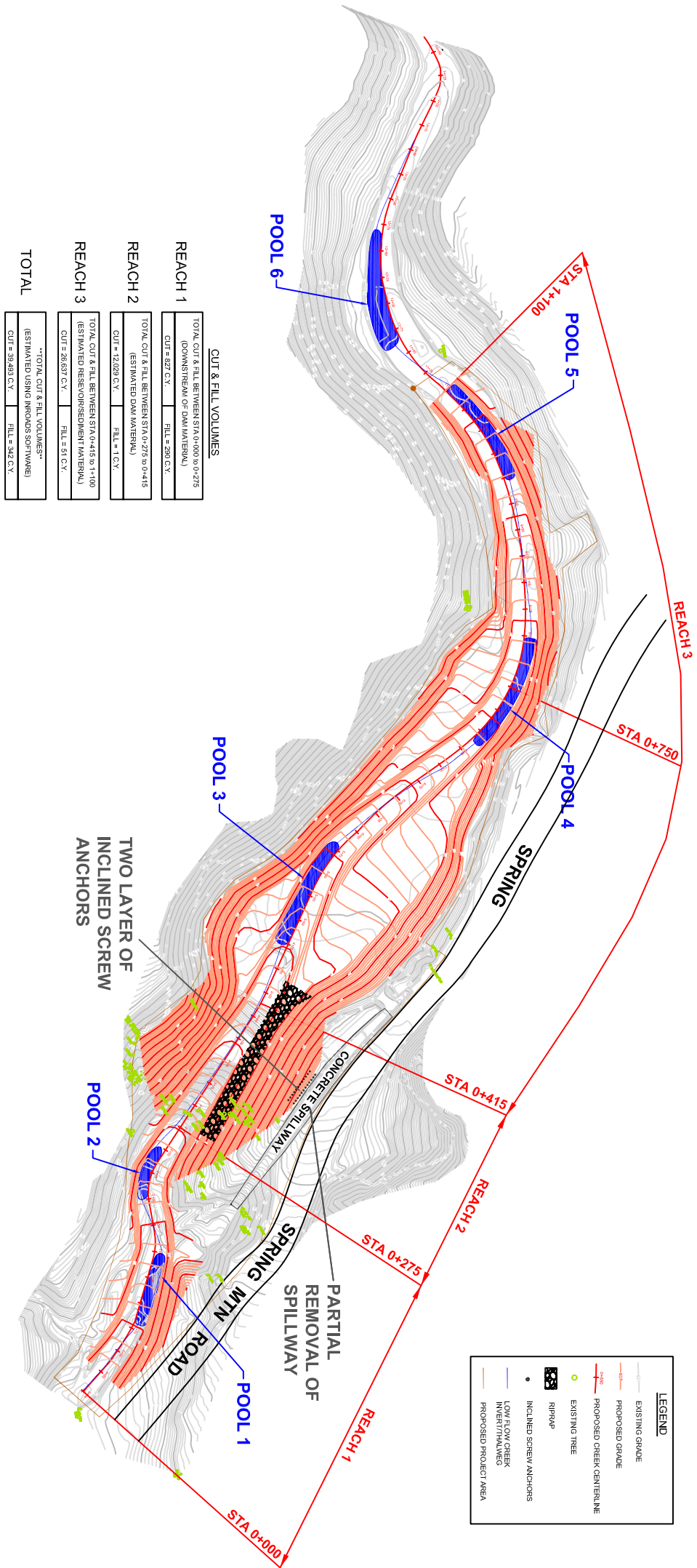
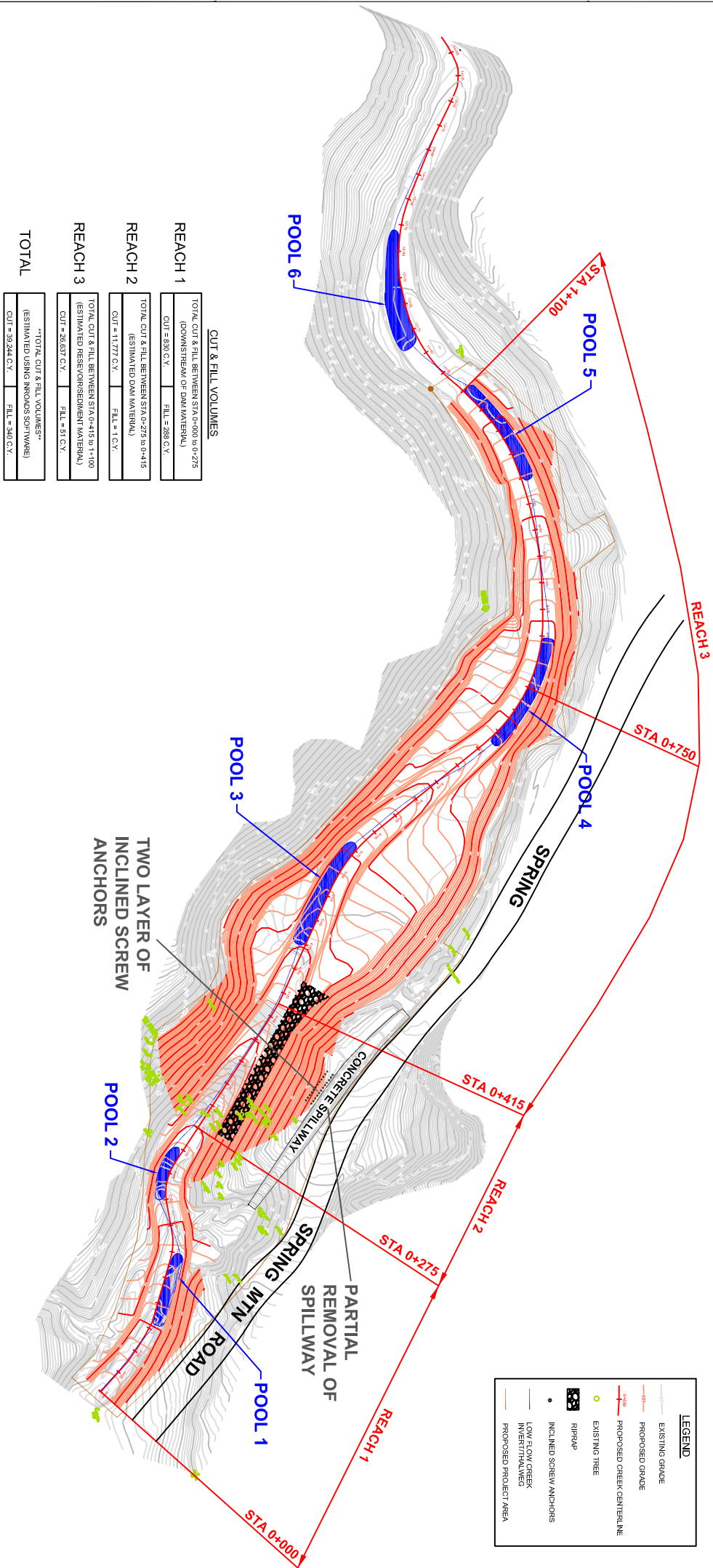


FIGURE 6

ALTERNATIVE 2B : STA 0+000 to 1+100 - Grade 5.09%

SCALE: 1" = 50'



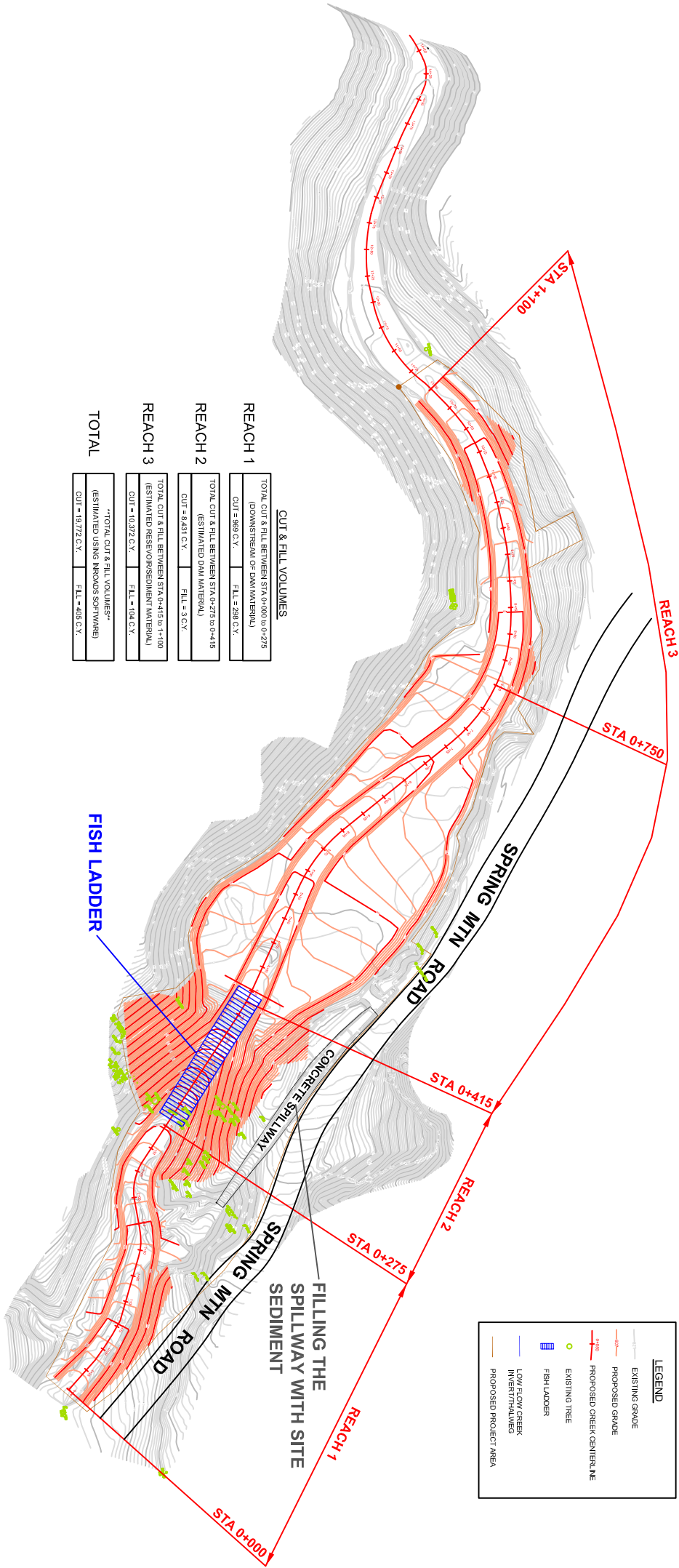
NOTE:

1. PARTIAL REMOVAL OF DAM AND SPILLWAY
2. MINIMUM NOTCH SIZE ON THE DAM
3. VEGETATED RIPRAP IS REQUIRED

FIGURE 7

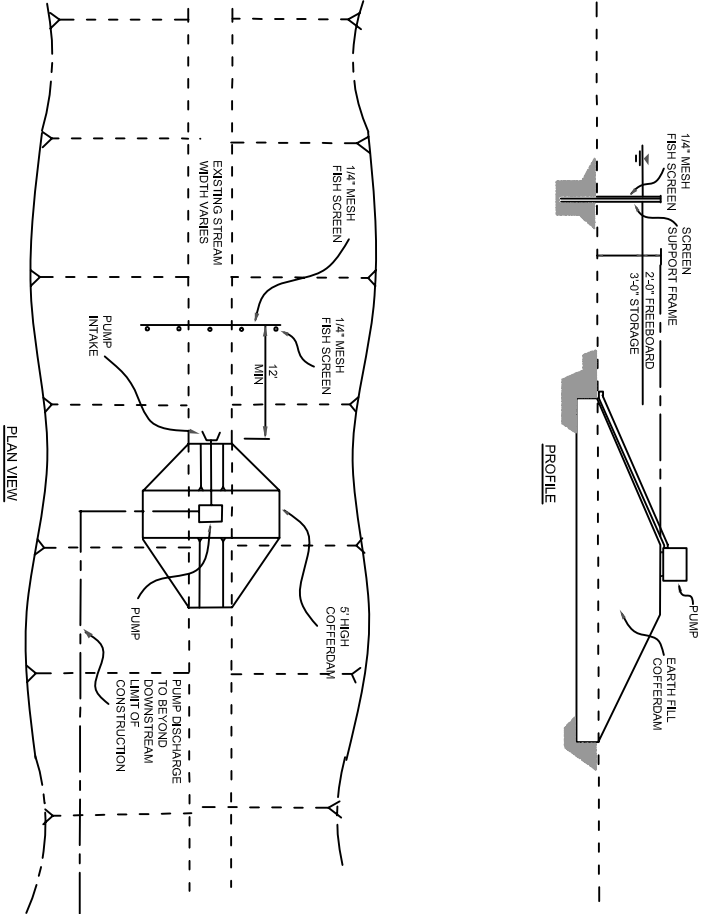
ALTERNATIVE 3 : STA 0+000 to 0+300 - Grade 5.09%
STA 0+300 to 0+380 - Grade 23.23% (Fish Ladder)
STA 0+380 to 1+100 - Grade 3.06%

SCALE: 1" = 50'



NOTE:
1. FILLING THE SPILLWAY WITH SITE SEDIMENT
2. FISH LADDER IS REQUIRED

FIGURE 8

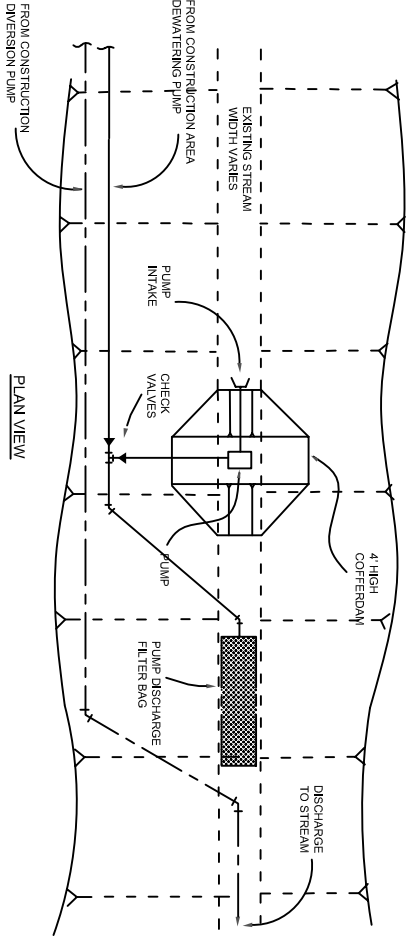
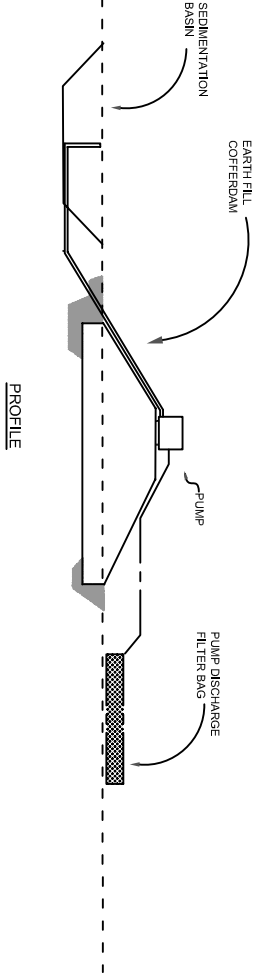


UPSTREAM CONSTRUCTION DIVERSION

N.T.S.

NOTES:

1. SCREEN MESH SIZE IS BASED ON NATIONAL MARINE FISHERIES SERVICE JUVENILE STEELHEAD CRITERIA. MAXIMUM VELOCITY AT SCREEN SHALL NOT EXCEED 0.80 F.P.S.
2. CONFIGURATION SHOWN IS GENERALIZED. ACTUAL CONFIGURATION IS DEPENDENT ON SITE TOPOGRAPHY.
3. PUMP SHALL BE SIZED BASED ON AN EXPECTED BASE STREAM FLOW OF 0.5-1.0 CFS (CONSTRUCTION PERIOD COMMENCES AFTER JUNE 15). A STANDBY PUMP SHOULD BE MADE AVAILABLE SHOULD SIGNIFICANT RAINFALL OCCUR DURING THE SUMMER CONSTRUCTION PERIOD.



DOWNSTREAM CONSTRUCTION DEWATER BASIN

N.T.S.

DETAIL - DOWNSTREAM CONSTRUCTION DEWATER BASIN

NOTES:

1. CONFIGURATION SHOWN IS GENERALIZED. ACTUAL CONFIGURATION IS DEPENDENT ON SITE TOPOGRAPHY.
2. PUMP SIZE IS DEPENDANT ON SUBSURFACE FLOW CONDITIONS THAT OCCUR DURING EXCAVATION.

PLAN VIEW

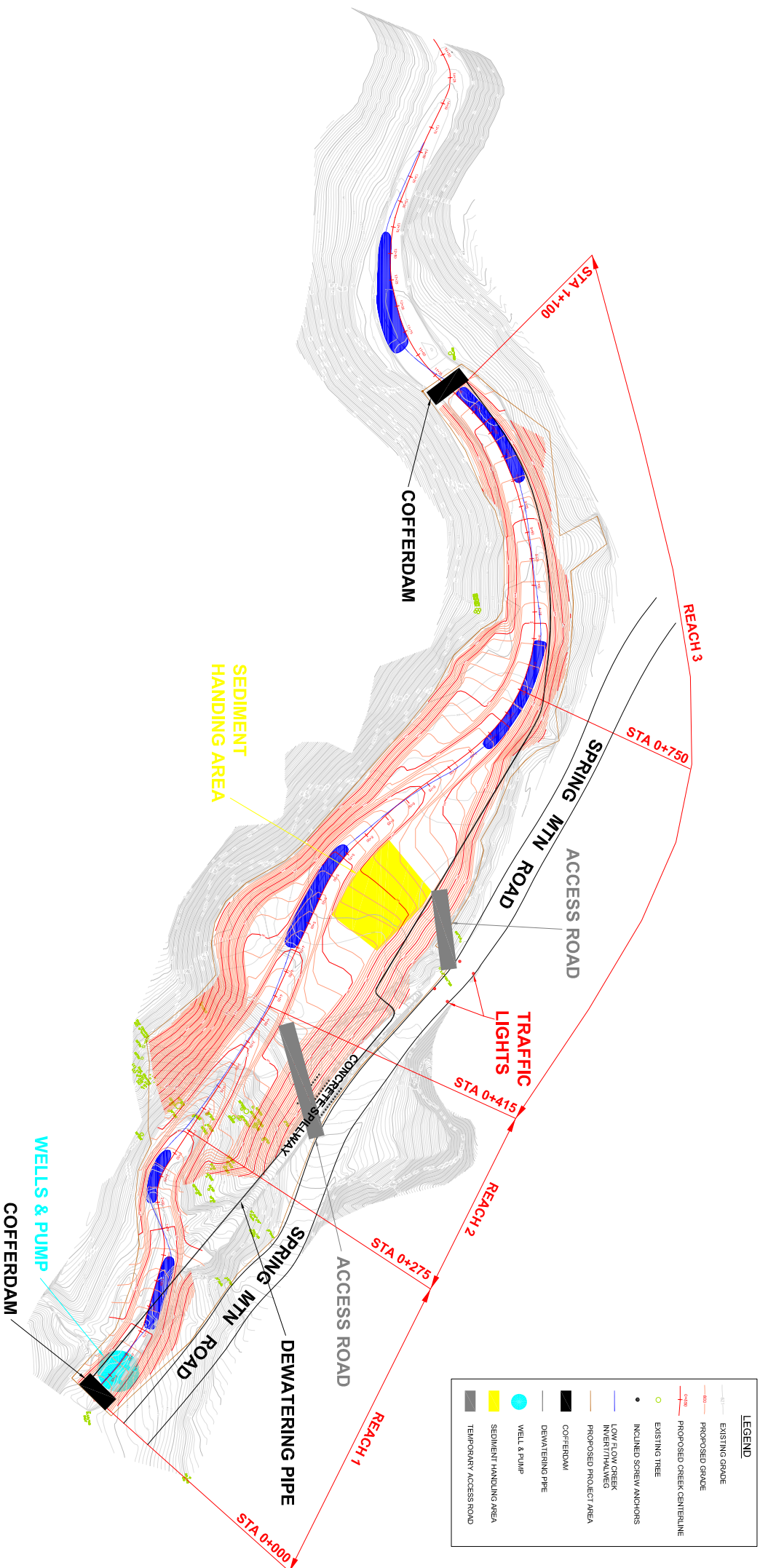
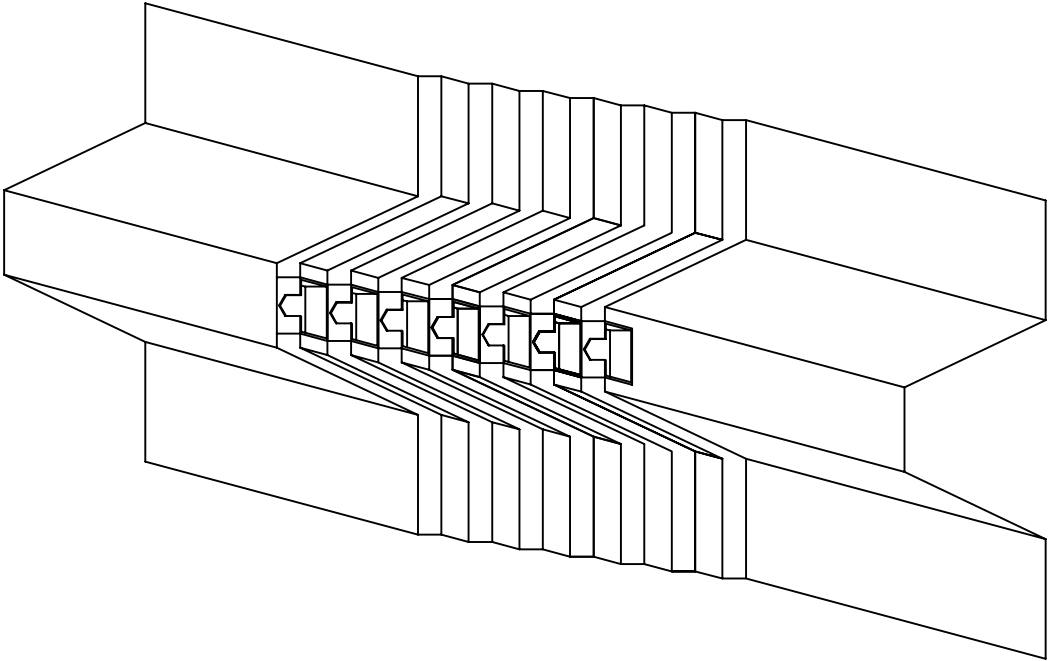
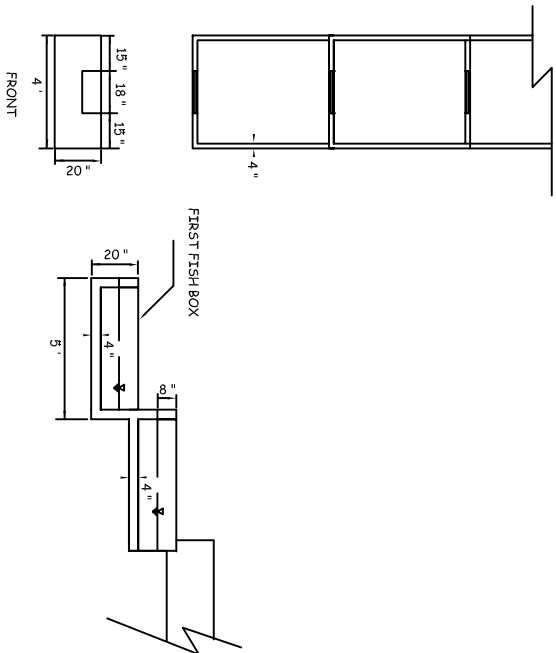


FIGURE 10



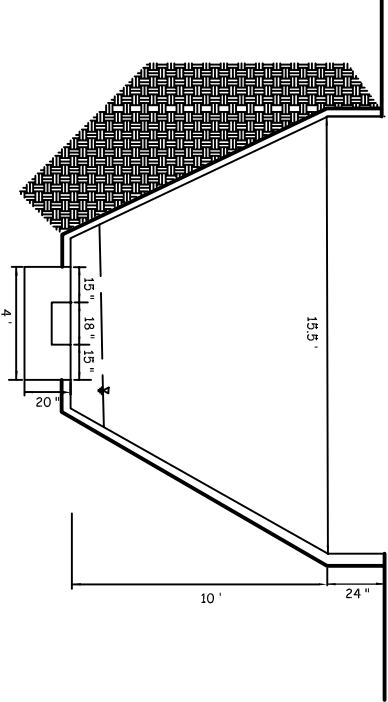
FISH LADDER FOR ALT 3

N.T.S.



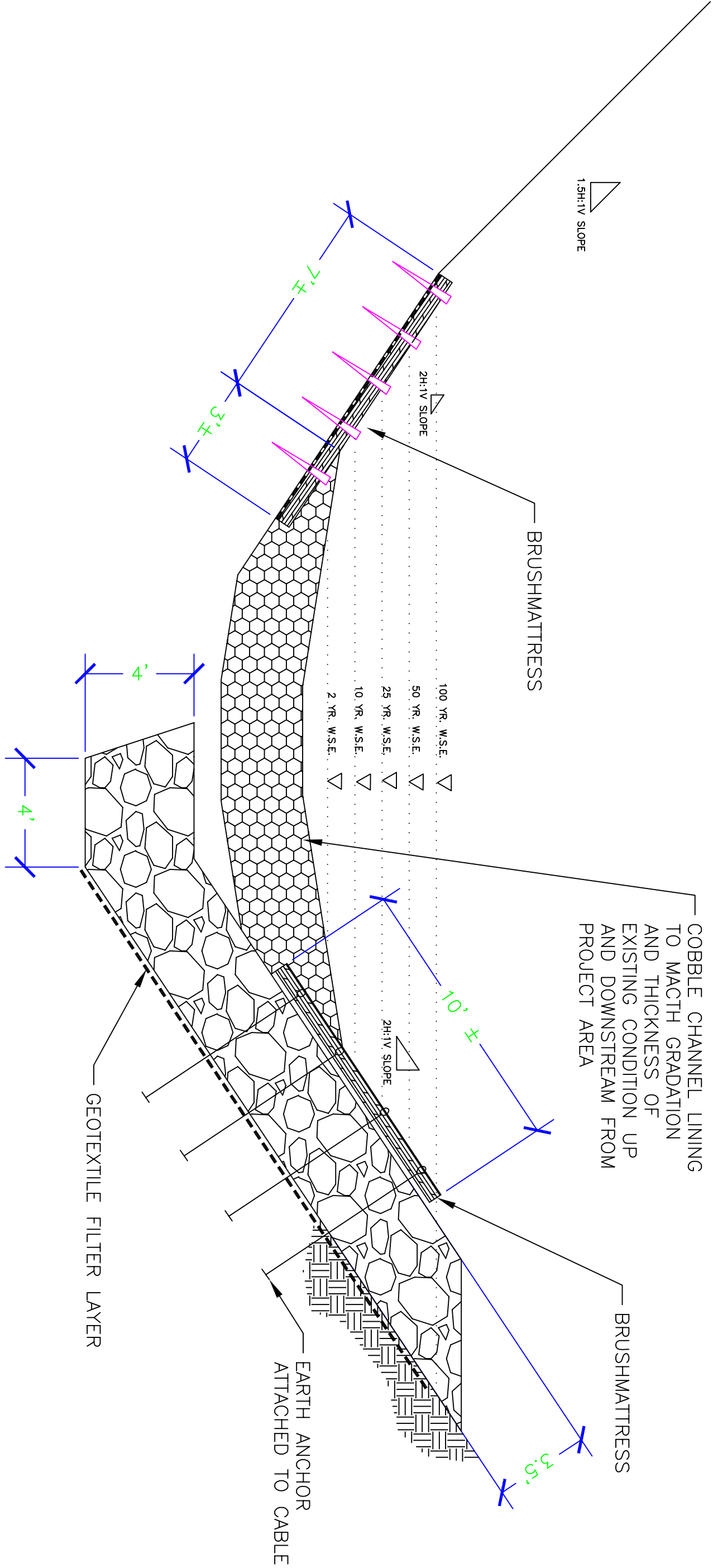
General Notes:

- Cast-in-place concrete fish box inside channel. Starting elevation at 57'1" for the first box.
- Maximum jump: 1 ft.
- Depth of pool: 1 ft.
- Minimum concrete strength 3000 psi @ 28 days.
- Steel wire mesh reinforcement @ 6" x 6"



Concrete channel with fish ladder in center of channel.

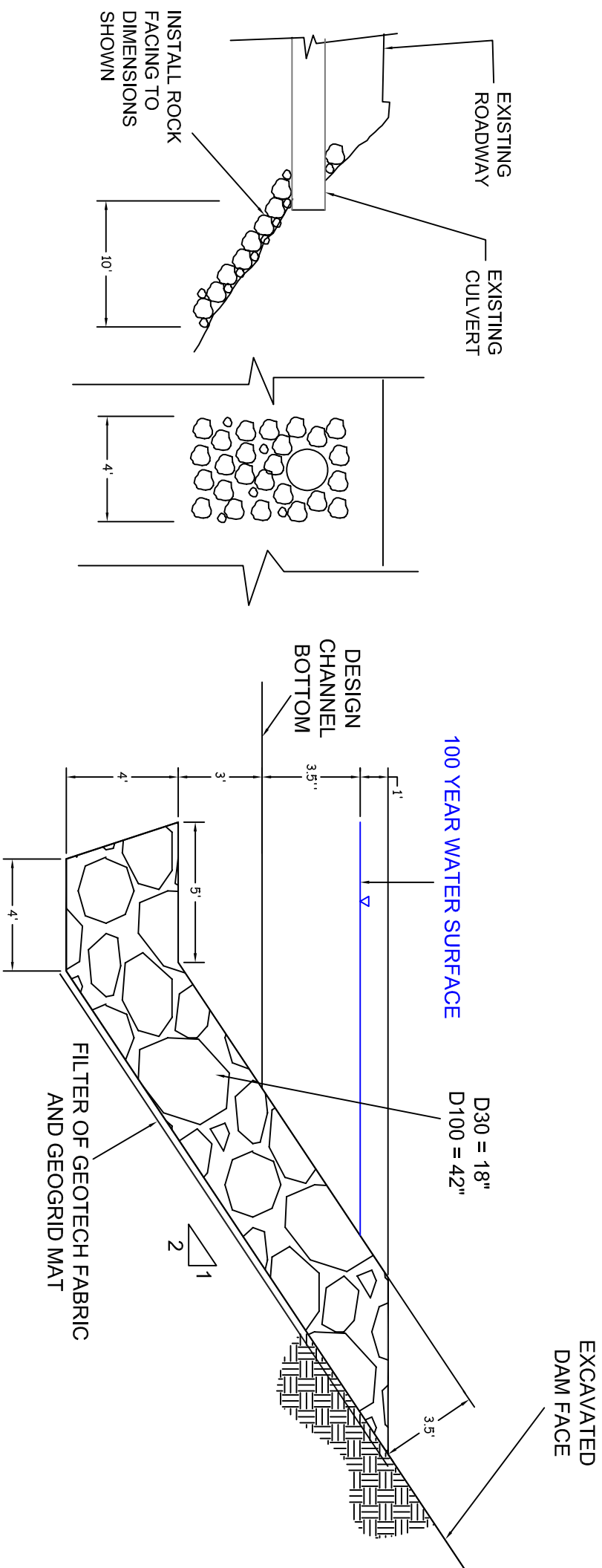
FIGURE 11



BRUSHMATTRESS AT DAM REMOVAL

N.T.S.

FIGURE 12



**EROSION PROTECTION AT
EXISTING CULVERTS**

N.T.S.

RIPRAP FOR ALT 2A & 2B

N.T.S.